

REMARKS

Reconsideration and allowance are respectfully requested.

The Non-Enablement Rejection Is Overcome. Claim 29 stands rejected under 35 U.S.C. §112, first paragraph, as allegedly being based upon a non-enabling disclosure. Claim 29 is canceled without acquiescing to the §112, first paragraph rejection, for reasons stated in the prior response in order to advance the prosecution of this application. Withdrawal of the rejection under 35 U.S.C. §112, first paragraph is respectfully requested.

The Obviousness Rejection Is Improper. Specifically, claims 1, 3-7, 9-17, 20-43 stand rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent 5,317,596 to Ho in view of U.S. Patent 6,597,745 to Dowling. This rejection is respectfully traversed.

Ho Is Admittedly Deficient. The Examiner states that Ho's echo canceller is "configured to estimate and remove echo signals in the frequency domain" referring to Figure 3 in column 5, line 65 to column 6, line 22. Ho also requires a time-domain echo canceller. See, for example, the time domain echo, $e(n)$, being subtracted from the received signal at summer 52 in Figure 3. Moreover, the abstract description of Ho's echo cancellation includes:

converting the frequency-domain transmit block to a time-domain transmit block, subtracting the end of the previous time-domain transmit block from the end of the current time-domain transmit block, performing a convolution of the adjusted time-domain transmit block and the time-domain echo parameters to produce a time-domain echo, subtracting the time-domain echo from a time-domain receive block of a received signal, converting the resulting signal to the frequency domain to produce a frequency domain receive block.

See also column 4, lines 34-42; claim 6, lines 10-13; and column 7, lines 10-14 and 25-44.

The Examiner admits that the Ho fails to disclose "that the echo signals are estimated with a combination of both a product of a first matrix and transmitted symbol and a product of a

second matrix and a previously transmitted symbol." For this deficiency, the Examiner relies on newly-cited Dowling.

Dowling Does Not Remedy Ho's Deficiency. Dowling *precodes* a signal *before* the signal is transmitted in order to compensate for channel distortion. The hope is that this precoded signal will be received without the receiver having to equalize the signal. In other words, Dowling tries to compensate for the channel distortion before transmission so that the signal is received more or less undistorted by the channel. Dowling is concerned about the far-end receiver and the received signal.

In contrast, the instant application is concerned the near-end transceiver and the echo that the near-end transceiver must deal with that is reflected back to the near-end receiver. While Dowling precodes the transmitted signal in order to simplify signal processing in the far-end transceiver, the instant claims remove echo in the in the near-end transceiver caused by the near-end transmitted signal. These are two very different problems.

Compensating For Channel Distortion Does Not Compensate For Echo. Dowling's invention has nothing to do with an echo canceller or echo cancellation. Dowling's precoder does not estimate and remove an echo signal from a received signal. Rather, Dowling's goal is to precode the transmitted signal in such a way that the distortion Dowling believes will be introduced by the channel will be minimized at the receiver. Dowling's channel distortion model *does not include echo cancellation*. Echo is caused by transmission line impedance mismatches, which is different from the channel transfer function. Echo is experienced at the near-end transmitter and not at the far-end receiver, which is where Dowling's concern is.

The Examiner makes passing reference to column 22, lines 1-3, where Dowling states that "communication systems often involve other elements such as echo cancellers which may be

advantageously merged with the precoder." This text actually undermines the position taken in the Office Action. Although Dowling's precoding techniques may in principle eliminate or reduce the need for time-domain equalization and frequency domain equalization (TEQ and FEQ) at the receiver, Dowling's invention does not perform echo cancellation. Dowling's precoder could be used on the transmit end together with an echo canceller used on the receive end. What Dowling admits in column 22, lines 1-3 is that his precoder does not perform echo cancellation. If you want to cancel echo, Dowling explicitly states that you need to use an echo canceller because the precoder will not.

The Combination of Ho and Dowling Fails Logically. Even if Dowling's precoder were combined with Ho's echo canceller, one would not arrive at claim 1. By the Examiner's own admission, Ho fails to disclose estimating echo signals in the frequency domain using the echo estimation matrix products recited in claim 1. Dowling's precoder, by Dowling's own admission, does not do echo cancellation. So if Ho's echo canceller and Dowling's precoder were combined, it is still just Ho's echo canceller doing the echo cancellation, which the Examiner rightly admits is not the claimed echo cancellation.

The Examiner errs in arguing that when "the Ho and Dowling references are combined, the echo canceller of Ho will estimate and remove echoes based upon the signal received on the transmission line. This signal will be the coded signal taught by Dowling." But Dowling's coded signal does not remove echo as already admitted by Dowling. And the echo removed by Ho is just the echo Ho would normally remove, which again the Examiner agrees does not meet the claim limitations.

The Combination of Ho and Dowling Fails Technically. Dowling's precoding modifies the transmitted signal using function which is supposed to be an inversion of the

channel transfer function. The hoped for result is the receiver gets a signal that is more or less unaffected by the channel transfer function. In order to precode, Dowling needs to have some knowledge of the transmission channel. The claimed echo cancellation actually subtracts the estimated echo from the transmitted signal. The result of the echo cancellation is the near-end receiver is more or less unaffected by the transmitted signal from the near-end transmitter being reflected back to the near-end receiver. No knowledge of the transmission channel is needed.

The Examiner should understand that the ISI and ICI in the transmitted signal are not the same as the ISI and ICI in the echo. So let's assume for the sake of argument that there were some provision to precode the signal to be transmitted for echo cancellation—which Dowling plainly does not—along with precoding for the transmission channel. The echo would be modeled and then inverted (call this X) just like the transmission channel is modeled and inverted (call this Y). But the consequence is that the echo modeling and inversion X negatively affects the inverted channel model Y resulting in distorting the received signal even more at the far-end receiver! That is why this modification would not be made. Further distorting of the signal at the far-end receiver and the need for more sophisticated equalization at the far-end receiver are the very things Dowling is trying to avoid. The Federal Circuit has clearly stated that a proposed modification that renders a reference inoperable for its intended purpose is an inappropriate foundation for an obviousness rejection. *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984).

On the other hand, if one directly applied Dowling's precoded signal to the input of Ho's echo canceller, the transmitted signal is only compensated for transmission ISI and ICI, which is what is input to Ho's echo canceller. But in this case, the echo ISI and ICI would not be compensated for but would instead be additionally distorted. Accordingly, Ho's echo canceller

cannot be combined with Dowling's precoder in the manner proposed by the Examiner to result in the claimed echo canceller. That proposed combination certainly does not result in estimating a echo signal in the frequency domain using the claimed combination of first and second matrices using by a transmitted symbol and a previously transmitted symbol.

Ho And Dowling Do Not Compensate for Echo ICI or ISI. Neither Ho nor Dowling disclose an echo canceller that takes into account effects of echo inter-carrier interference (ICI) and inter-symbol interference (ISI) in a frequency domain model in an echo estimate so that it can be subtracted out from the received echo at the transmitter. Claim 30 recites the additional feature that the frequency domain estimate of the echo takes into account both the effects of the echo intersymbol interference and inter-carrier interference. As explained in the background, ICI is not the same as ISI. Nor is ICI a form of "noise". For the Examiner's information, two articles are included with this response to support this point. If the Examiner continues to contend that ICI is ISI or "noise", Applicants request that the Examiner cite evidence to support that contention. Notwithstanding this confusion about ICI, neither Ho nor Dowling describe compensating for the effects of echo ICI and ISI at the near-end receiver as opposed to the effects of transmission channel ICI and ISI at the far-end receiver.

Claims 18, 19, and 44 stand rejected under 35 U.S.C. §103 as being unpatentable over newly-cited U.S. Patent 5,117,418 to Chaffee et al in view of Dowling. This rejection is respectfully traversed.

Chaffee discloses an echo canceller in which the estimated echo is converted to the time-domain and subtracted from the received signal. The Examiner admits that "Chaffee does not disclose that the echo signals are estimated with a combination of both the product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted

symbol." Again, the Examiner relies on Dowling. The reliance is misplaced for the reasons explained above. Nor has the Examiner made clear how Chaffee and Dowling could be combined. Chaffee describes a time-domain echo canceller, and Dowling describes recursive precoding in the frequency domain. It is unclear how that combination would result in Chaffee's echo canceller having improved performance.

Many of the dependent claim features are also distinguishable over the applied prior art. Because the primary rejections fail to disclose or suggest the claimed echo canceller, it is unnecessary to address these additional distinguishing features.

The application is in condition for allowance. An early notice to that effect is earnestly solicited.

Respectfully submitted,

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